CE CIT UOB

ITCE260 (Circuit Analysis)

Test 2

Time: 60 minutes **Date: 25 May 2015**

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Name:	**Sec: 1**	**ID #:**

Q1 **[20 marks]**

For the circuit in Fig. 6.66, calculate the value of *R* that will make the energy stored in the capacitor the same as that stored in the inductor under dc conditions.

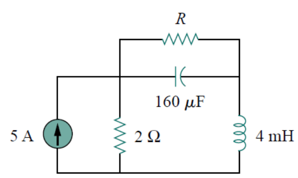
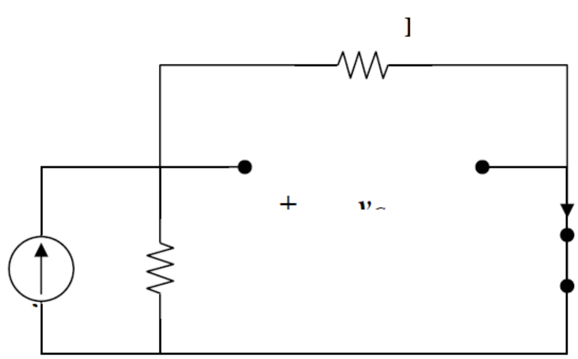


Figure 6.66 For Prob. 6.41.

Under dc conditions, the circuit is equivalent to that shown below:



$$i_L = \frac{2}{R+2}(5) = \frac{10}{R+2}, \quad v_c = Ri_L = \frac{10R}{R+2}$$

$$w_c = \frac{1}{2}Cv_c^2 = 80x10^{-6}\,x\,\frac{100R^2}{(R+2)^2}$$

$$w_L = \frac{1}{2}Li_1^2 = 2x10^{-3}\,x\,\frac{100}{(R+2)^2}$$

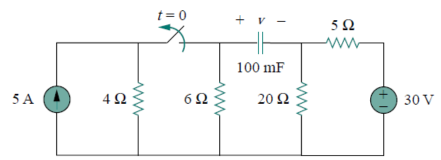
If $w_c = w_L$,

$$80x10^{-6}\,x\,\frac{100R^2}{(R+2)^2} = \frac{2x10^{-3}x100}{(R+2)^2} \longrightarrow 80 \text{ x } 10^{-3}R^2 = 2$$

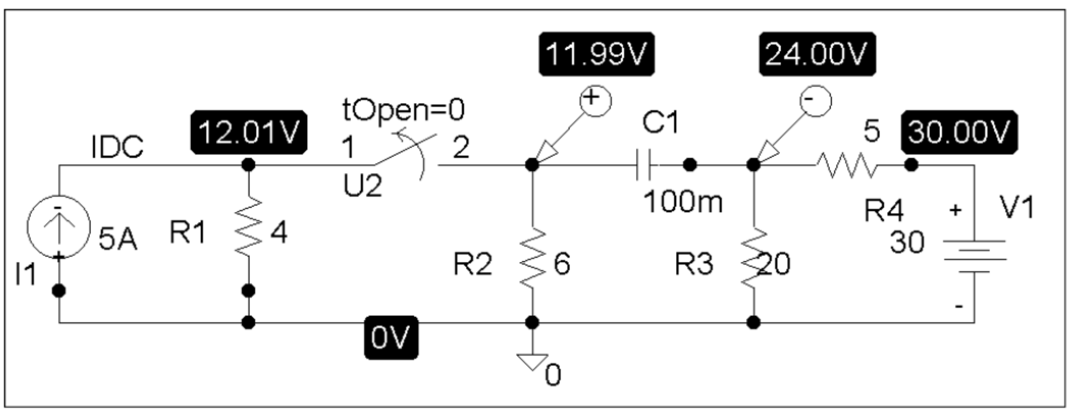
$$R = \underline{\mathbf{5\Omega}}$$

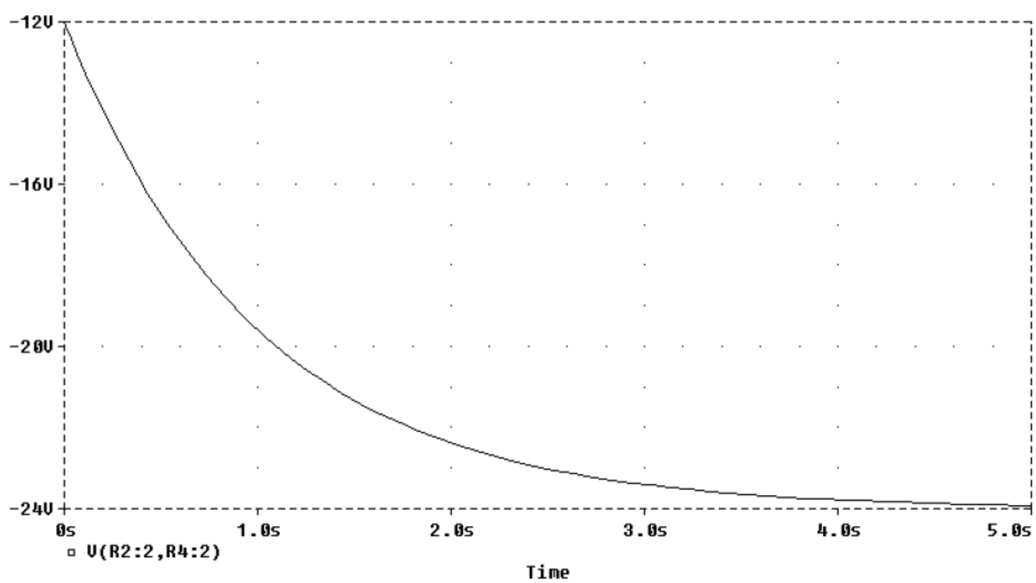
Q2 **[40 marks]**

The switch was left closed for a long time then opened at t = 0.
Find the voltage across C and the current at **t = 0, 0.5 s, 1 s, 3 s, 5 s and t = ∞**



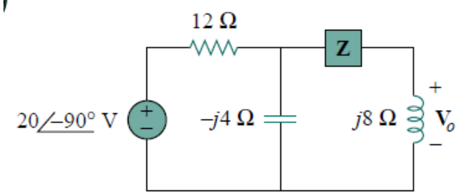
The schematic is shown below. We click Marker and insert Mark Voltage Differential at the terminals of the capacitor to display V after simulation. The plot of V is shown below. Note from the plot that V(0) = 12 V and V(∞) = -24 V which are correct.

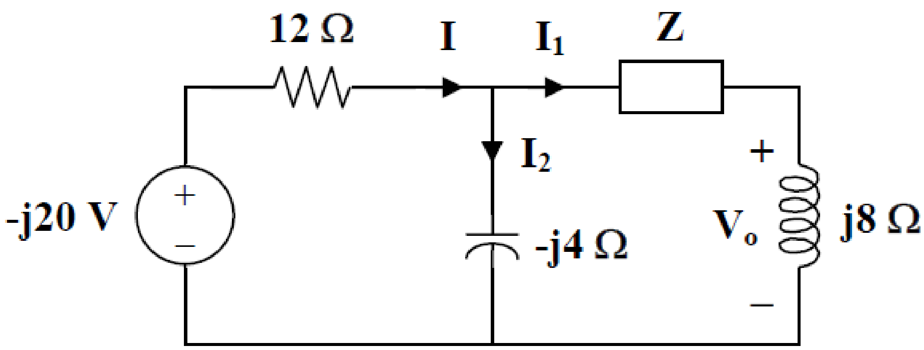




Q3 **[40 marks]**

Find **Z** in the network of Fig. 9.57, given that $\mathbf{V}_o = 4\angle 0^\circ$ V.





$$\mathbf{I}_1 = \frac{\mathbf{V}_o}{j8} = \frac{4}{j8} = -j0.5$$

$$\mathbf{I}_2 = \frac{\mathbf{I}_1(\mathbf{Z} + j8)}{-j4} = \frac{(-j0.5)(\mathbf{Z} + j8)}{-j4} = \frac{\mathbf{Z}}{8} + j$$

$$\mathbf{I} = \mathbf{I}_1 + \mathbf{I}_2 = -j0.5 + \frac{\mathbf{Z}}{8} + j = \frac{\mathbf{Z}}{8} + j0.5$$

$$-j20 = 12\mathbf{I} + \mathbf{I}_1(\mathbf{Z} + j8)$$

$$-j20 = 12\left(\frac{\mathbf{Z}}{8} + \frac{j}{2}\right) + \frac{-j}{2}(\mathbf{Z} + j8)$$

$$-4 - j26 = \mathbf{Z}\left(\frac{3}{2} - j\frac{1}{2}\right)$$

$$\mathbf{Z} = \frac{-4 - j26}{\frac{3}{2} - j\frac{1}{2}} = \frac{26.31\angle 261.25^\circ}{1.5811\angle -18.43^\circ} = 16.64\angle 279.68^\circ$$

$\mathbf{Z}$ = **$\underline{2.798 - j16.403\ \Omega}$**